



# **DARPA Agent Markup Language (DAML)**

*Enabling Dynamic Targeting Via Agent-Based WWW Technologies*

**Murray A. Burke**  
**IXO**



## Army

- Center for Army Lessons Learned
- Warrior Knowledge Network
- Web Mapping Testbed



## Joint Global Command & Control System

- Global Command Support System
- JOPES 2000
- Advanced Course Of Action ACTO
- CINC21
- Joint Center for Lessons Learned System



- Joint Battlespace Infosphere
- Theater Battle Management Core System
- BroadSword
- Air Mobility Command GDSS



## Navy

- Expeditionary Sensor Grid
- Task Force Web
- Navy Lessons Learned System
- Navy Warfare On-Line Library



## Marines

- Air - Ground Combat System
- Distance Learning Network
- Logistics Bases Inventory Visibility
- Items Applications On-Line
- Master Header Information On-Line

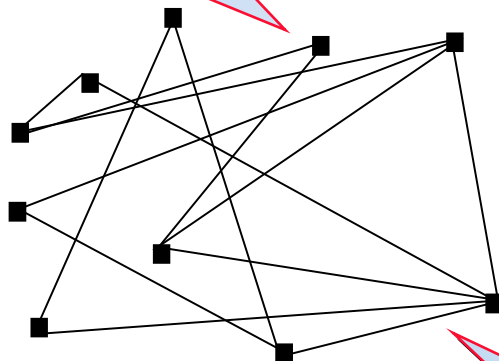
## Intelligence Community

- Intelink
- Joint Intelligence Virtual Architecture
- Cryptology
- Crypto Analysis Web
- NIMA Geospatial Engine

Average WWW searches examine only about 25% of potentially relevant sites

Doubles in size every six months

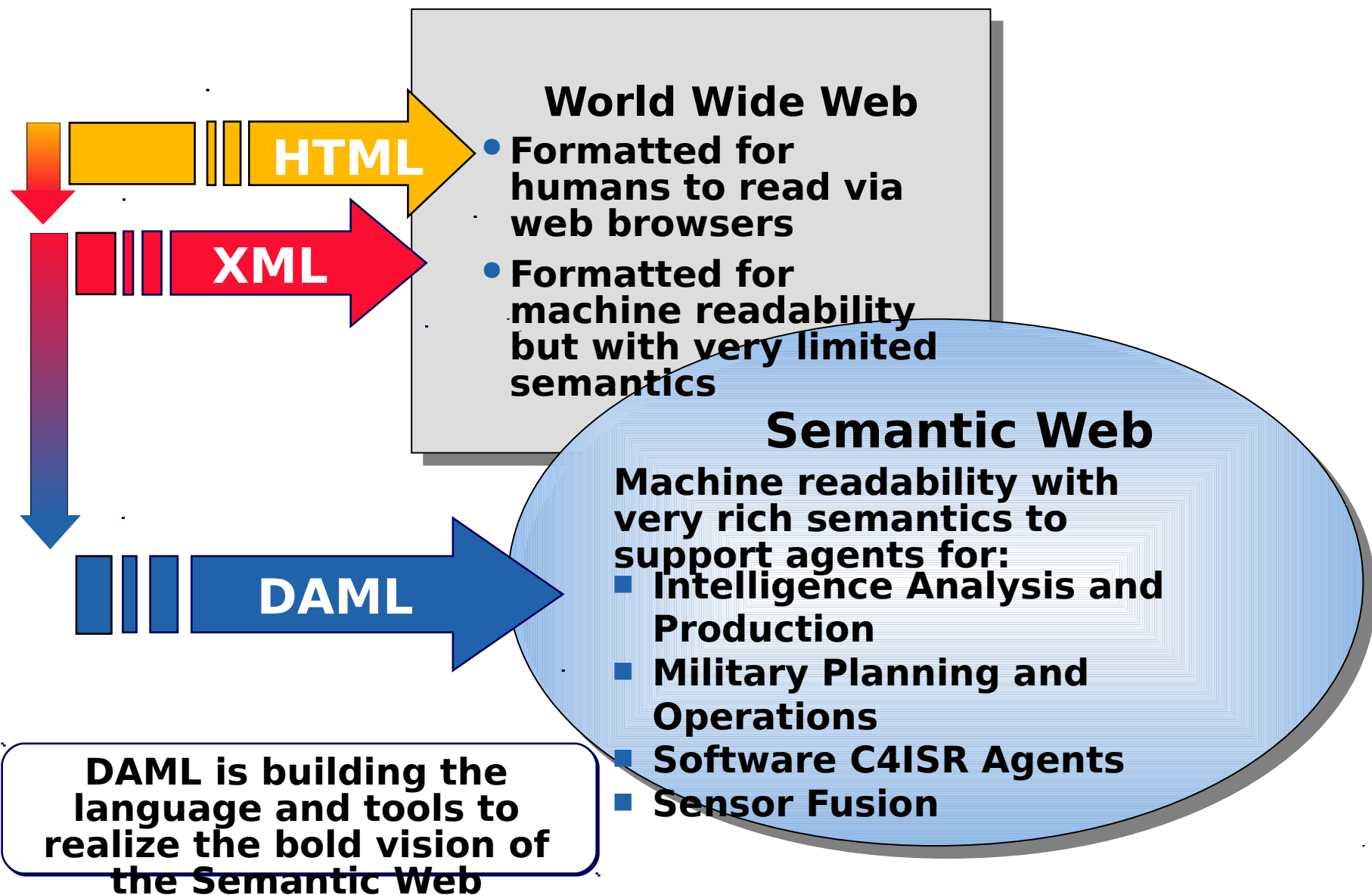
World Wide Web  
Intelink-S  
Intelink



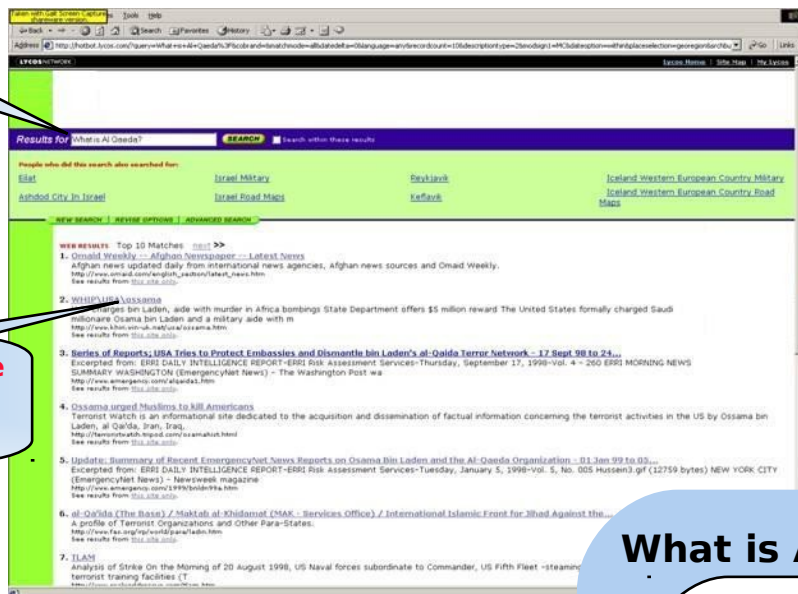
Problems grow worse as Web continues to grow

Web searches return a lot of unwanted information

Information on web is not suitable for software agents



What is Al Qaeda?



The answer may be somewhere in this list of URLs

**39,800  
Matches on  
6 March  
2002**

**With  
DAML**

**Improved Precision  
and Recall**

- Correct word sense
- Synonyms

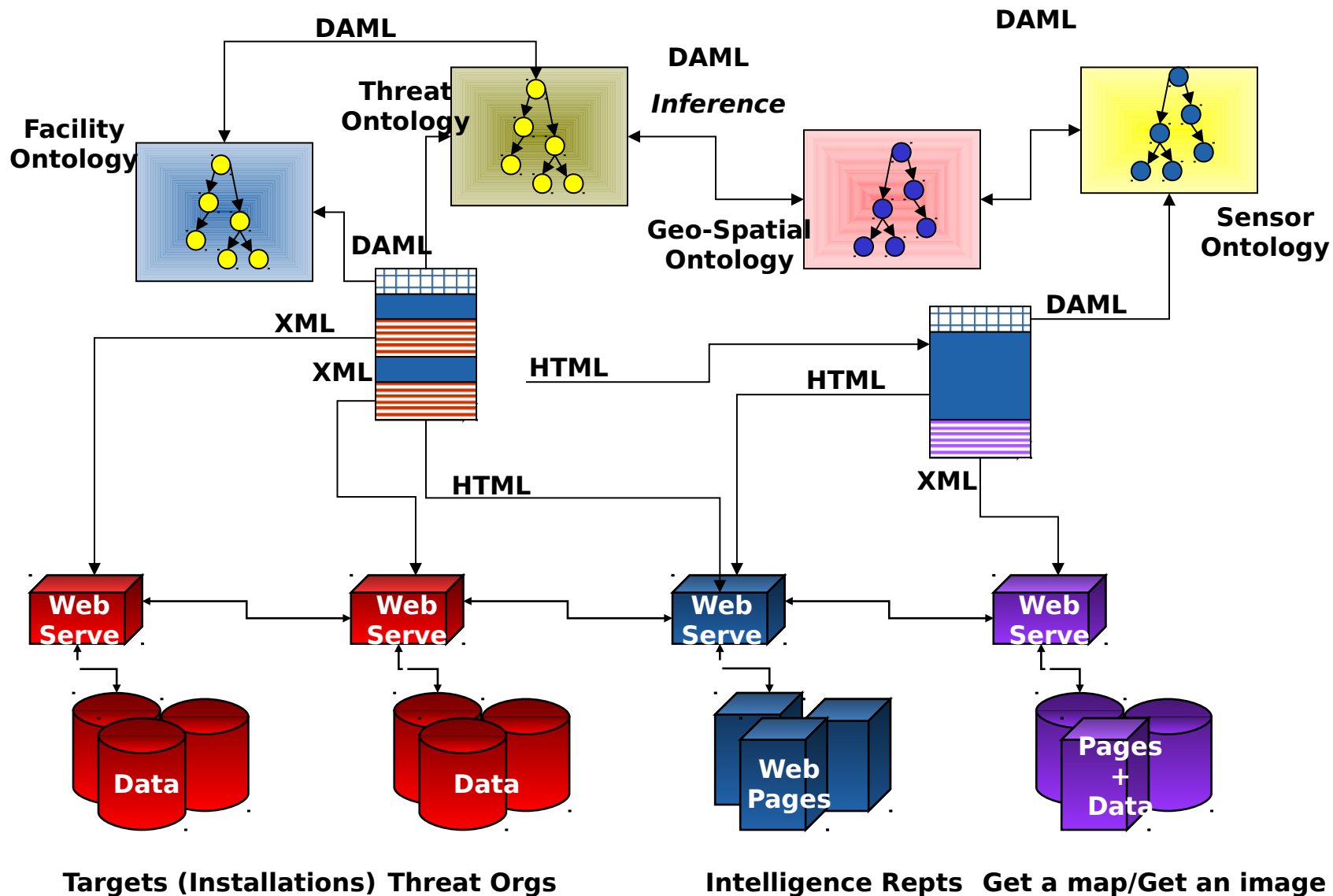
What is Al Qaeda?

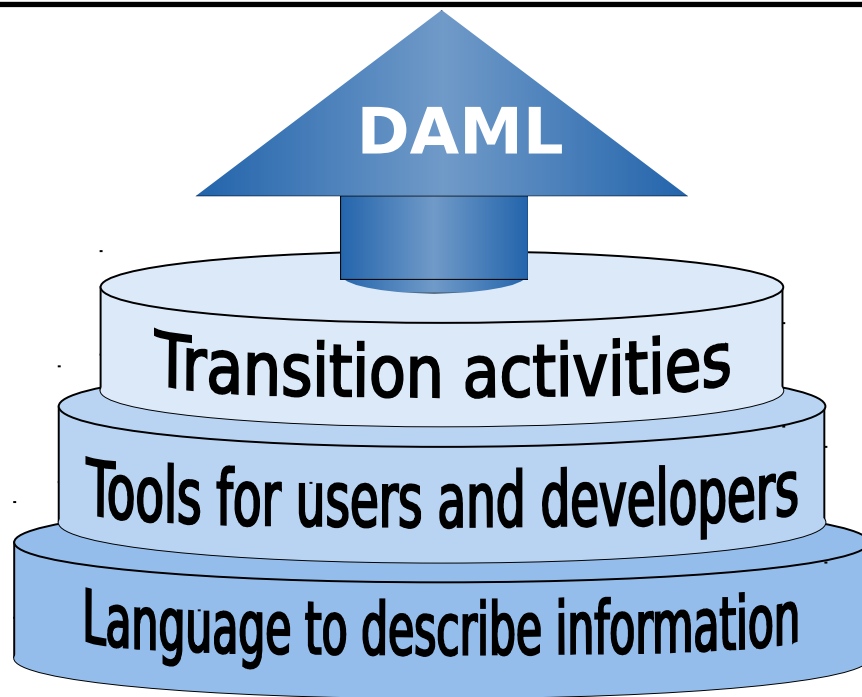
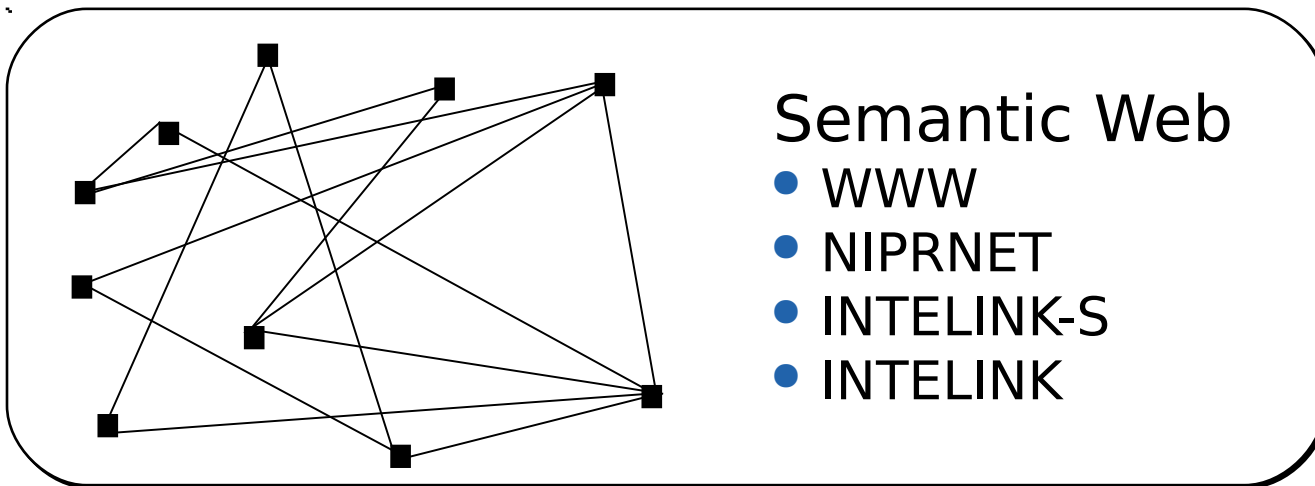
**A terrorist organization**

**Would you like additional information on?**

- Membership
- Locations
- Structure
- Finances
- Tactics
- Other terrorist organizations

# The DAML Idea





## ■ Formal Semantic Underpinnings

- Model-Based
- Axiom-Based

### ■ Ontologies

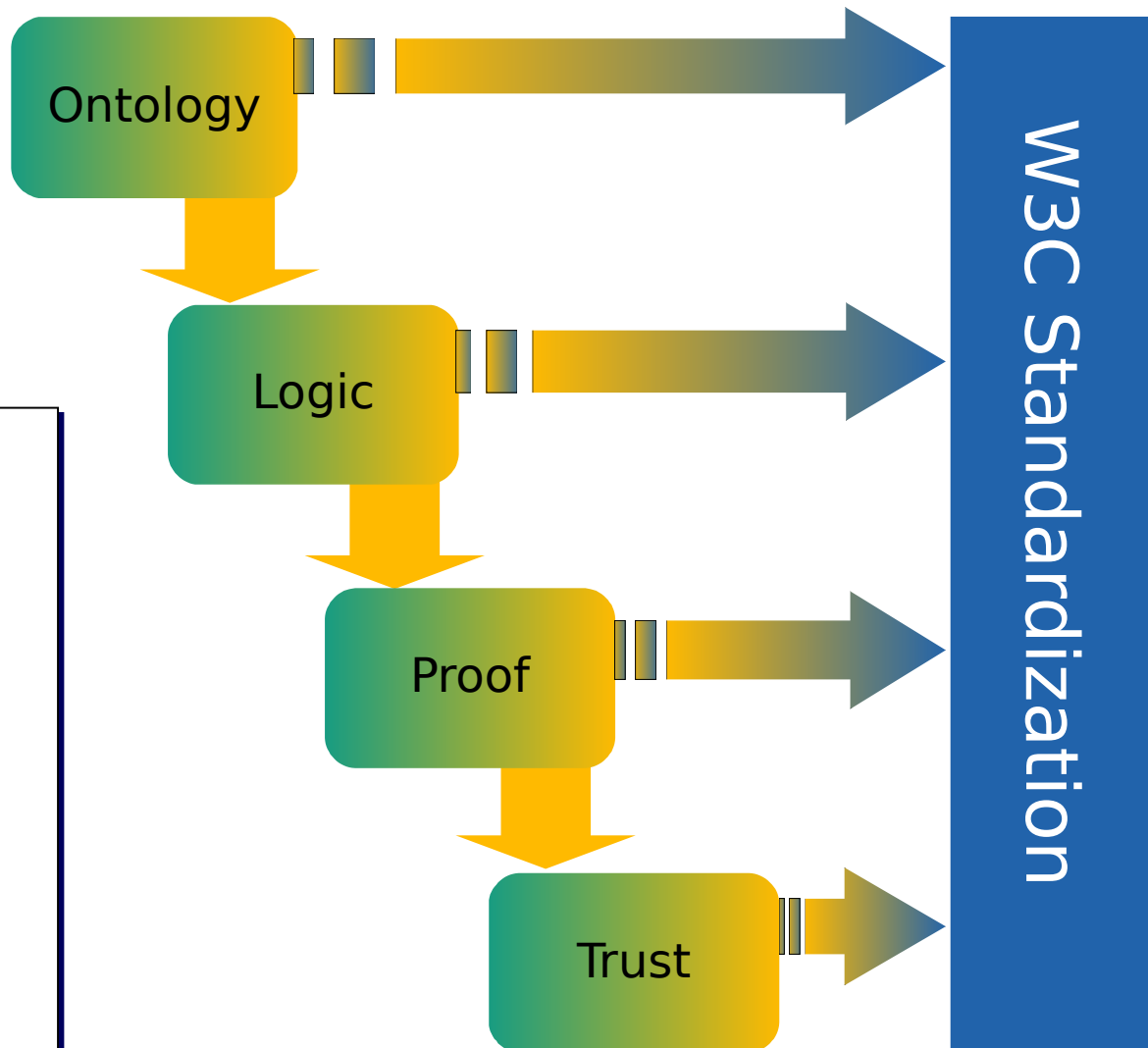
- Query Language
- Spatial-Temporal
- Domain Ontologies

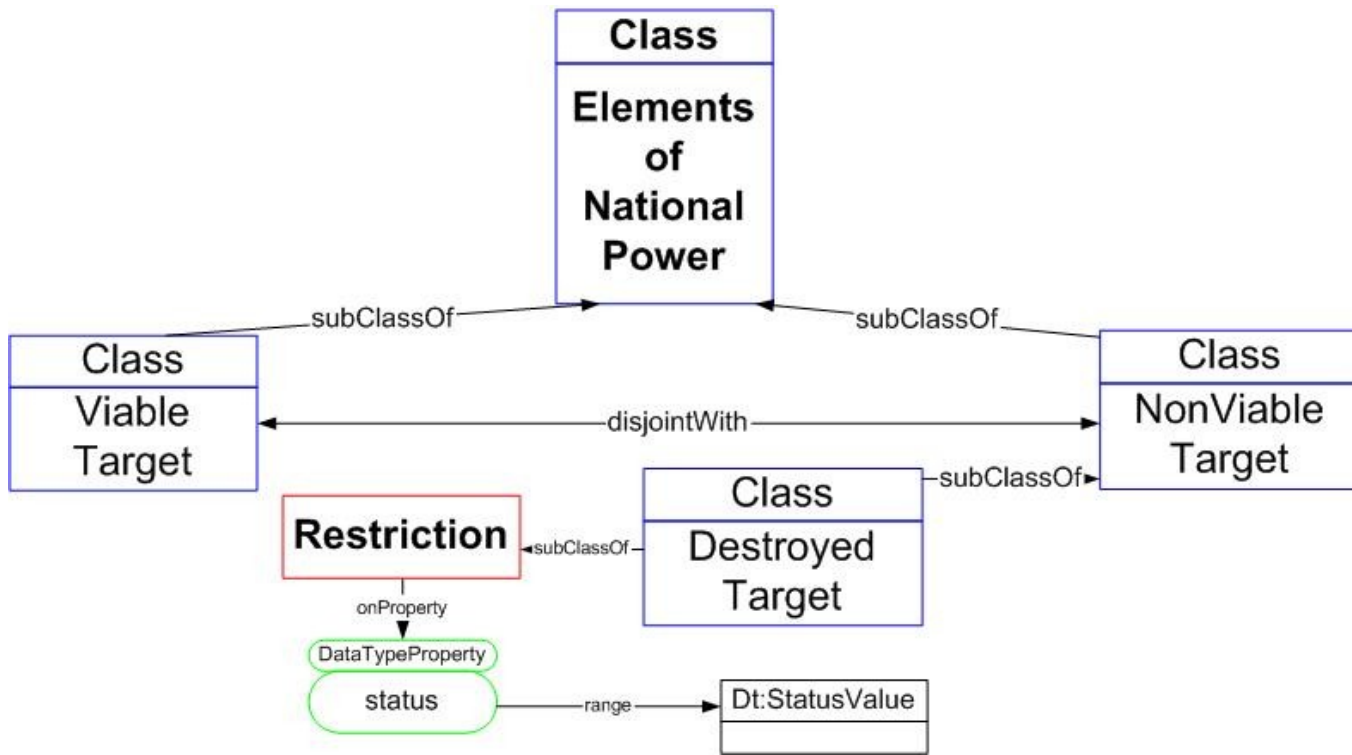
### ■ Rules

- Services
- Security

### ■ Proof

### ■ Trust





## Implies

- If x is status is destroyed, then not viable target
- If x is status is damaged, then it may or may not be viable target
- If x is viable target, then status is not destroyed
- If x is not viable target, then status may or may not be

## Operational Prototype Tools

APIs

Report  
Generator

Edit

Validation/  
Analysis

Browser

Visualize/  
View

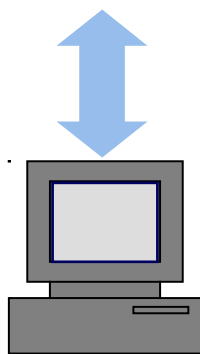
Parser

Inference

Import

Search/Query

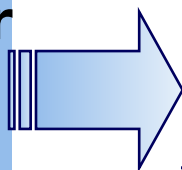
Transform



**Developer and  
User Tools**

**Semantic Web**

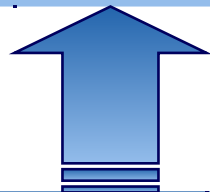
**DAML  
Semantic Web for  
Military Users  
Conferences**  
(Identify Requirements)



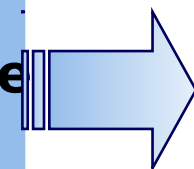
## DoD Projects

- Intelink Management Office: Horus
- Navy: Expeditionary Sensor Grid
- Air Force: Foreign Clearance Guide
- Army: Center for Lessons Learned
- Army: Warrior Knowledge Network
- TRANSCOM: Global Transportation Network
- Air Force: Joint Battlespace Infosphere
- Navy: Task Force Web

**DAML**



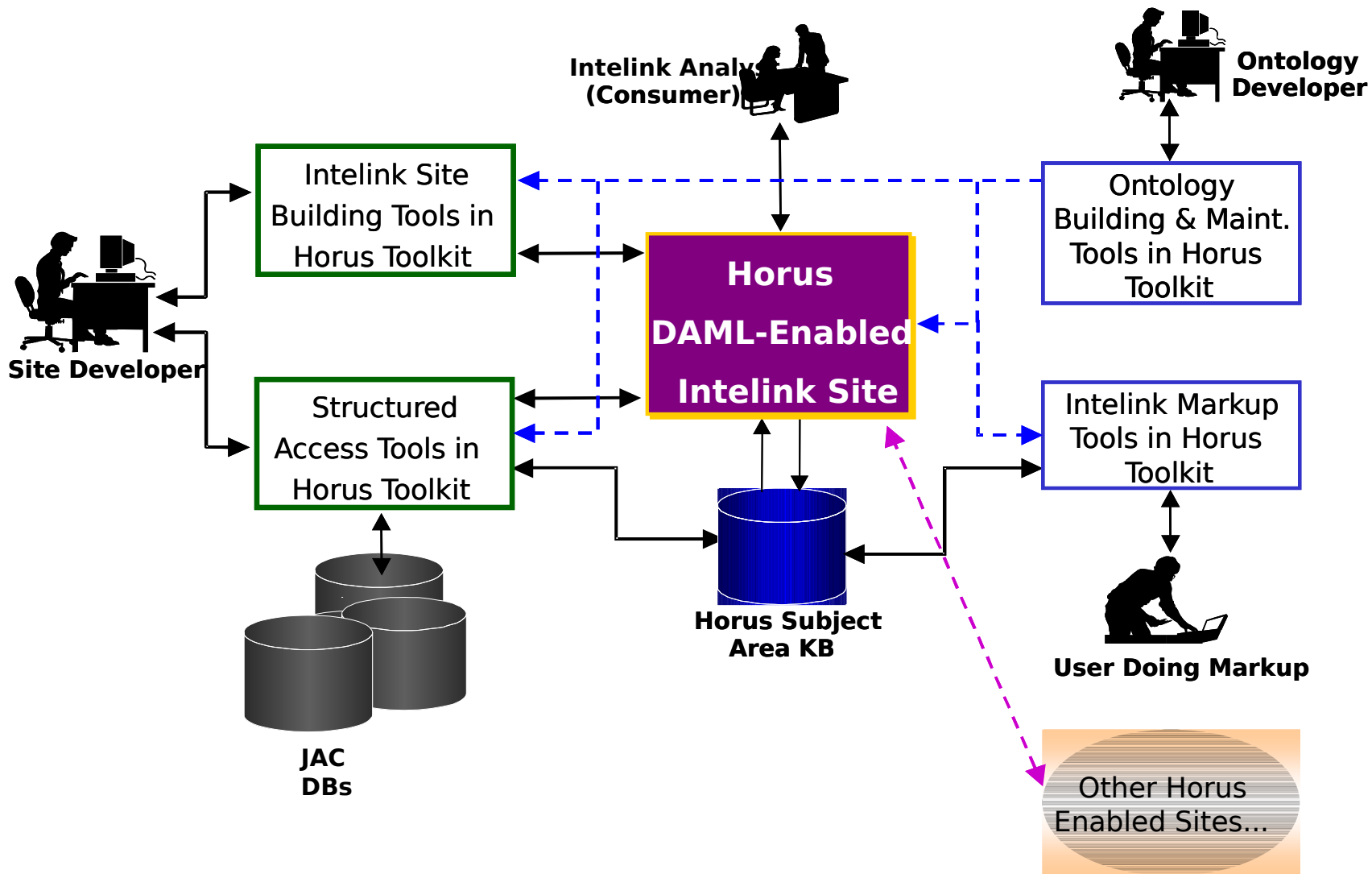
**www.daml.org  
Website Keeps the  
World Informed  
about DAML  
Technology**



## Commercial Projects

- W3C Web Ontology Working Group
- U of MD ITTALKS
- BioInformatics Consortium
- Web-Enabled Ontology of Software Eng
- Agentcities Network
- SemTalk Visio Graphical Representation

# Horus Transition



**Sep 01**

**1 Node**  
**1 Ontology**  
**3 Data Base**  
**1 Agents**

**May 02**

**Technical**

**3-4 Nodes**

**4 Ontologies**

**3-5 Data  
Bases**

**2 Agents**

**2002  
Experiment**

**Functional**

**1 Operation/Enemy**

**3-5 MIL  
Organizations**

**1 ONA/COA**

**Sep 02**

**Technical**

**4-5 Nodes**

**6-8  
Ontologies**

**5-7 Data  
Bases**

**3-5 Agent**

**Functional**

**2 Operations/1  
Enemy**

**>10 US  
Organizations**

**2 ONA/COAs**

**Vision**

- Millions of Nodes
  - Millions of Ontologies
  - Millions of Data Bases
  - Millions of Agents
  - All Operations
- Active on the Semantic Web**

- **Military Adopting WWW Technologies Extensively (HTML/XML)**
- **DAML Builds Upon and Extends HTML/XML to Provide Information “Meaningful” to Software Agents**
- **Enormous Military and World Wide Commercial Interest in DAML Because of W3C Acceptance**
- **Networks of Linked Ontologies Are at the Heart of the DAML Idea**
- **Extensive Set of Prototype DAML Tools Under Development**
- **Important Transition Activities Include Intelink and Air Mobility Command-Foreign Clearance Guide**
- **New CJTF Targeting Challenge Problem Being Defined with JFCOM/PACOM As Operational Backdrop for Experimentation and Metrics**